

NOAA's AVHRR Archive

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Abstract

The Satellite Data Services Division (SDSD) maintains a digital browse file of Advanced Very High Resolution Radiometer (AVHRR) data. The AVHRR instrument is aboard the TIROS-N series of spacecraft. The instrument has five channels for viewing the earth, two channels are in the visible part of the spectrum and three are in the infrared portion of the spectrum. Selected data from this instrument are converted to digital browse files and loaded on the Image Library and Browse System (ILABS). The ILABS allows SDSD personnel to review data before the digital tapes are sent to satisfy the user's order. It also allows hardcopy images be sent to users. Working in conjunction with the ILABS is the Electronic Catalog System (ECS). The ECS is able to be directly accessed by the user community and it allows the users to find data in their areas of interest. Once the data are found, then that data can be ordered from the SDSD.

1. Introduction

The Satellite Data Services Division (SDSD) of the National Satellite, Data and Information Service's, (NESDIS) National Climatic Data Center (NCDC) acquires, manages, and maintains data from the NOAA Polar Orbiter Advanced Very High Resolution Radiometer (AVHRR). The SDSD is mandated by law to archive these data and has the principle authority to make them available to the user community. The SDSD takes a multi-faceted approach to this responsibility by maintaining a digital tape archive of Level 1b data and a hardcopy browse facility. In addition to the AVHRR Level 1b archive, derived products are available from SDSD. Examples of these derived products are the Global Vegetation Index and the Radiation Budget products. These products are not discussed in the article but information on them and other products can be obtained from SDSD.

The digital and hardcopy browse files are from the TIROS-N series of spacecraft. This series began with the successful launch of TIROS-N in October 1978. The latest satellite in the series to be launched successfully was NOAA-H in September 1988. Three additional satellites are planned for this series: NOAA-D, NOAA-I and NOAA-J.

2. AVHRR Instrument

The AVHRR instrument was designed as a five channel radiometer with a cross track scan pattern. There are two visible channels and three infrared (IR) channels. The AVHRR instruments aboard the TIROS-N, NOAA-A, -B, -C, and -E satellites had only four unique channels. The fourth IR channel was repeated in channel 5. The AVHRR instruments aboard the NOAA -D, -F, -G, -H, -I, and -J satellites have five unique channels.

Channels 1 and 2 are in the visible portion of the electromagnetic spectrum. Channel 1 has a wavelength range of .55 - .68 micrometers. Channel 2 has a wavelength range of .725 - 1.1 microns. These channels have a spatial resolution of 1.1 km when the satellite is at a nominal altitude of 833 km.

Channels 3, 4 and 5 are in the IR region of the spectrum. Channel 3 is in the near IR, 3.55 - 3.93 microns, Channels 4 and 5, if different from channel 4, are in the far IR, 10.50 - 11.50 and 11.50 - 12.50 microns, respectively. Their resolution is also about 1.1 km.

3. Data Availability

The AVHRR instrument has two basic types of instrument readouts: Global Area Coverage (GAC), and Local Area Coverage (LAC)/High Resolution Picture Transmission (HRPT). The GAC format has a resolution

of about 4 km. This format is used for coverage over an entire orbit. LAC/HRPT format is used for selected portions of the satellite's orbit and has a resolution of about 1.1 km.

The LAC data is recorded for preselected areas where no HRPT is available. The LAC data are transmitted later to either Wallops Island, VA or Gilmore Creek, AK. The LAC data coverage is scheduled prior to that orbit. For current or retrospective data requirements, users should contact SDSD to place an order. For future or continuing data needs users should coordinate with the Interactive Processing Branch (IPB) of NESDIS/ Satellite Services Division (SSD) to schedule new coverage, or to assure that current schedules are adequate for anticipated needs (i.e. number of overpasses, specific geographic location, or priority). Requests accepted must be received at least thirty days prior to the data acquisition period. Written requirements information should be sent to the following address:

CHIEF, INTERACTIVE PROCESSING BRANCH
NESDIS, Room 510
World Weather Building
Washington, DC 20233
Telephone: (301) 763-8142

Requests are assigned on a strict priority, first-come, first-served basis, and time available. If the requests are approved, they are encoded and sent up to the satellite for implementation at the proper time. Once confirmation of coverage is received from IPB SDSD should be contacted for pricing and payment policies, and to place an order for the data.

Requests are based on the following priority considerations:

1. National emergencies
2. Situations where human life is immediately endangered
3. U.S. strategic requirements
4. Commercial requirements
5. Scientific investigations and studies
6. Miscellaneous activities

Requests must include the following:

- a. Description of application
- b. Geographical area
- c. Latitude and longitude of boundary area
- d. Desired frequency of coverage
- e. Spectral channels required for image processing
- f. Type of data — digital on CCT or photographic images
- g. Beginning and end of study time
- h. Satellite preference
- i. Name, address, and telephone number of requestor

If the request is scheduled, no fee is charged for the scheduling activity.

The HRPT data are available from anywhere the satellite's signal can be received. NESDIS maintains

ground stations at Wallops Island VA and Gilmore Creek AK to receive HRPT data. These stations receive HRPT data from over the east and west coasts of the North America. HRPT data are usually received when the satellite is within sight of a station. The LAC and GAC must first be sent from the satellite central processing facility in Suitland MD. Along with the GAC and LAC data from the ground stations, HRPT data may also be sent to the central processing facility. The data are then processed and made available to users. A principle user is the National Weather Service who uses mapped products generated by NESDIS in forecasting models.

The AVHRR data are available from the SDSD. Requests may be sent to the following address:

NATIONAL OCEANIC
AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENT SATELLITE, DATA,
AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER
SATELLITE DATA SERVICES DIVISION
Princeton Executive Square, Room 100
5627 Allentown Road
Washington, DC 20233
Telephone: Commercial (301) 763-8400
FTS 763-8400
NESDIS Telemail: SDSDDSB/NCDC
OMNET: K. METCALF
FAX: (301) 763-8443

4. Archive tools

The Image Library and Browse System (ILABS) and the Electronic Catalog System (ECS) are tools used in the selection of data sets. The ILABS and ECS complement each other. The ILABS allows SDSD personnel to access AVHRR images on a PC based image processing system from an image file stored on optical disks. The ECS allows users to find what information is available and, more importantly, if that information may satisfy their initial need. With these two systems in place, the ability to service requests should increase. Users will be able to exactly specify the data they need. The amount of time lost by SDSD personnel looking for data that does not meet the users need should decrease significantly. Users eventually will be able to look at on-line low resolution images in the area of interest from their remote terminals once enhancements are completed. Many searches now done by SDSD personnel will be performed by the users themselves. The amount of time spent by a user in waiting for a search to be done by SDSD personnel can then be more profitably used in analyzing the requested data when these two systems are used. The browse files are not designed to provide on-line data access, only a quick look to indicate whether data is suitable for the user.

4.1 Image Library And Browse System (ILABS)

The ILABS became operational in October 1990. The system has three main components: software that runs on the NESDIS Data Processing and Services Subsystem (DPSS), software that runs on the Satellite Archive and Retrieval System (SARS), and the ILABS workstation. The DPSS software creates the necessary browse files. The ILABS workstation takes these files and copies them to the browse storage media. The ILABS was designed to browse the image data, search for specific data, enhance image displays, create an inventory of the image data, and as a limited function produce a hard copy (See Figure 1).

The software that runs on the DPSS uses the AVHRR Level 1b in real time as its input to generate the necessary archive browse files needed for the ILABS workstation. The software will archive the HRPT, LAC, and GAC data sets onto a computer compatible tape (CCT) which is then used as the input to the ILABS workstation (See Figure 2).

The software that runs on the SARS uses AVHRR Level 1b historical data as its input. This data is converted to the necessary browse file needed for the ILABS workstation. An output CCT is created similar to the cct that is created from the realtime AVHRR received DPSS software. The historical tapes are created on an as needed basis to meet the requests of the users. The ILABS workstation is composed of a P.C., an erasable optical disk system, a high resolution graphic monitor, a tapedrive for reading the tapes from the DPSS, an optical scanner, a text monitor, and a laser jet printer (See Figure 3). In addition to the hardware, image display software was written for the workstation. This software does the image display, tape copy to the image media, creates the inventory records, and determines what files will satisfy the requests for data for a specific geographic area.

The DPSS software only generates a browse file with a visible channel (channel 2) and an infrared channel (channel 4) on a regular basis. The software does have the capability to generate browse files using different or all the AVHRR channels but this feature is not being used because of time constraints. Future enhancements could include all five channels that are available on the AVHRR. Additional enhancements may become available as time goes on depending on the requests from the user community.

The ILABS currently allows SDSD personnel to scan the AVHRR archive for requested information. It is currently supplementing the film browse facility. It will be phased in to eventually replace the film browse facility. The ILABS allows SDSD personnel to fill orders from the user quicker with fewer problems because they will have the images on hand and the cumbersome

searches of the film browse facility will not have to be made.

4.2 Electronic Catalog System (ECS)

The ECS was made available to the user community in February, 1988. The ECS was designed when it became apparent to SDSD personnel that they would not be able to keep up with user requests for data. The ECS is a more efficient system than the previous system of manually looking for each of the data sets. Included in the ECS are the inventory records for the TIROS Operational Vertical Sounder (TOVS) data and the HRPT/LAC from April 1985. In addition, the inventory of 4 km GAC from 1978 to the present plus a limited amount of HRPT/LAC data from 1978 to the present plus a limited amount of HRPT/LAC data from 1978 to 1985 is available.

The ECS is currently located on a DEC 10 computer using the 1022 database and operated by time sharing service. It will be moved to a MicroVAX 3300 computer using the Sybase database. The user needs only a terminal, modem and a telephone number with the correct access codes to use the system. The ECS is menu driven. It includes a help function that allows the first time user to access the system efficiently. Other options are available to more experienced users. The option to be discussed here is the Polar Search Function. When this option is selected, the user is put into an interactive mode which aids him in finding the information he wants.

The search process asks what type of data type is wanted. Then the date is selected. This range must be between one and one hundred and eighty days. When this is completed, all data sets that meet this criteria are selected. These data sets are placed in an array format which indicates the type of data and the satellite. The user selects satellite and data type before additional commands can be input. Once this decision has been made then the geographic search is done. Once this is done, then an array of data sets that meet these requirements are displayed. If additional dates are needed, then additional one hundred and eighty day ranges can be selected.

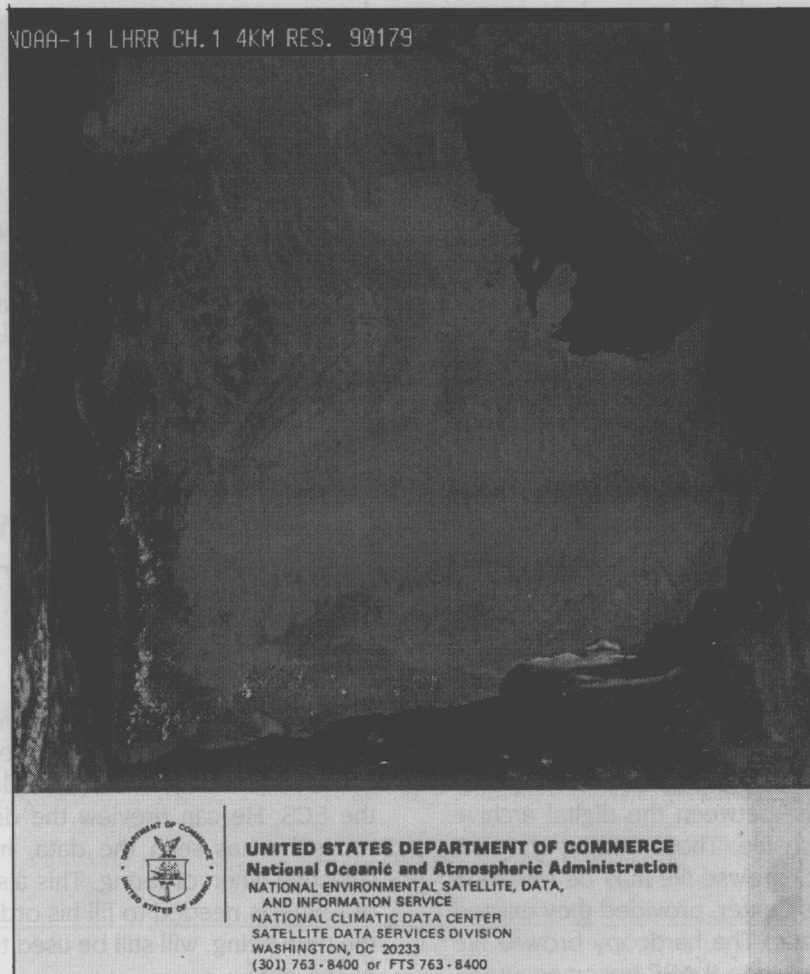
In a future enhancement, the user will have the option to look at a low resolution image of his data sets to determine which ones meet his requirements. Another enhancement will allow the user to see what percentage of the image is cloud covered. An order option has been included in the ECS menu but requests will not be processed unless a payment plan has been set up with SDSD. Information on how to access the ECS can be gotten from the SDSD.

5. AVHRR Hardcopy Browse Facility

The SDSD maintains a photographic browse file of AVHRR data to satisfy user requests. The browse file

IMAGE LIBRARY AND BROWSE SYSTEM (ILABS)

NOAA-11 LHRR CH.1 4KM RES. 90179



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
 NATIONAL ENVIRONMENTAL SATELLITE, DATA,
 AND INFORMATION SERVICE
 NATIONAL CLIMATIC DATA CENTER
 SATELLITE DATA SERVICES DIVISION
 WASHINGTON, DC 20233
 (301) 763-8400 or FTS 763-8400

Figure 1.

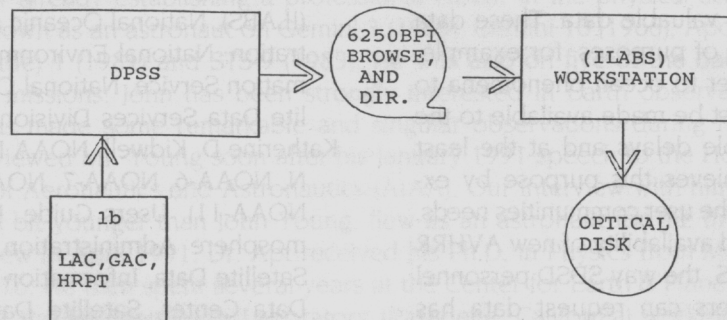


Figure 2. (ILABS) Browse file generation and store

DPSS FUNCTIONS

- REFORMAT AND COMPRESS AVHRR 1B LAC, HRPT, AND GAC TO BROWSE FILE FORMAT.
- GENERATE BROWSE DIRECTORY.
- COPY BROWSE FILES AND DIRECTORY TO 6250 BPI TAPE.

ILABS WORKSTATION FUNCTION

- GENERATE O.D. BROWSE DIRECTORY.
- TRANSFER IMAGE FILES AND DIRECTORY INFORMATION TO O.D.

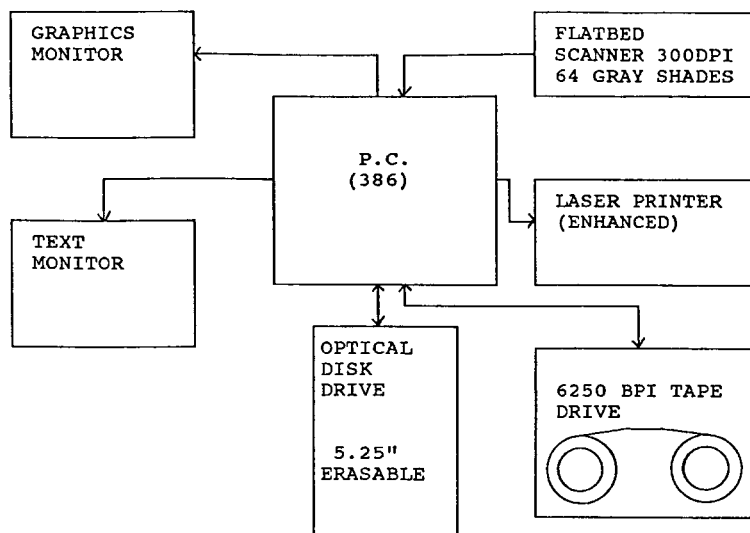


Figure 3. ILABS workstation configuration

- PRIMARY WORKSTATION FUNCTIONS**
- TAPE TO OPTICAL DISK FILE TRANSFER
 - BROWSE INVENTORY SEARCH
 - HARD COPY IMAGE SCAN AND STORE
 - SOFT COPY ROOM, ENHANCE
 - HARD COPY GENERATION
 - INVENTORY FILE EDITING

includes GAC, LAC, HRPT, and computer generated GAC images. It currently contains all available images from 1978 to the present time. A one-to-one correspondence doesn't always exist between the digital archive and photographic browse file. Those images that are not available in the SDSD browse file may be retrieved from the Federal Records Center, provided they existed in the film or paper format. The hardcopy browse file will eventually phase out as the ILABS becomes operational.

6. Conclusion

The AVHRR instrument provides the user community with a large amount of valuable data. These data can be used for a multitude of purposes, for example, from determining snow cover to ocean phenomena to cloud cover. These data must be made available to the user with the fewest possible delays and at the least cost to him. The SDSD achieves this purpose by expanding its services to meet the user communities needs.

With the development and availability of new AVHRR browse tools, ILABS and ECS, the way SDSD personnel find data and the way users can request data has changed. Prior to browse tool development, the SDSD personnel had to look through LAC coverage sheets and paper ephemeris records before going to the hardcopy browse files to find what data was actually available to fill the user requests. Today, a search is first done by the SDSD personnel using ILABS and if the data is not available there, then the hard copy browse files are searched. The amount of time needed

to find the data is reduced. As more data is put into the ILABS, the search times will become faster. The user has a better idea of what is available to him because of the ECS. He can preview the data using the ECS. Because he has seen the data, he can be much more selective when ordering. This also reduces the number of requests needed to fill his order. The browse file, for the time being, will still be used to look at the suitability of the data.

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